Test and Evaluation

10 mm Semi-Automatic Pistol

May 1990

DISCLAIMER

The opinions, findings, conclusions, and recommendations expressed in this report are those of the California Highway Patrol (CHP). These findings are based on the evaluation of specific weapons that were unconditionally submitted for consideration by manufactures who produce a semi-automatic pistol that fires any 10mm bullet.

The procedures and methods used during this test to evaluate weapon performance and suitability are unique to the California Highway Patrol and its function as a public service agency. These procedures and methods do not necessarily conform to those used by any other organizations involved in evaluating weapon performance. Nevertheless, this report does contain the opinions and conclusions of the California Highway Patrol, along with specific experiences encountered by the California Highway Patrol test staff during the administration of this study. This report also contains a recommendation for the weapon system found to be most suitable for adoption by the California Highway Patrol as a service weapon. Neither the report nor its recommendation is intended to endorse the use or adoption of any specific make or model firearm by any other person, business or organization.

C A L I F O R N I A H I G H W A Y P A T R O L

10MM WEAPON TEST AND EVALUATION

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I. Introduction

In September of 1989, the Academy Weapons staff presented to Executive Management the results of the evaluation Commissioner Hannigan requested regarding the new 10mm cartridge and its potential for adoption by the California Highway patrol. The pistols from which this new cartridge was fired were not in production and it was not possible to properly evaluate them at that time. However, the cartridge was evaluated and found to perform very well. The cartridge was determined to be well within the acceptable range for CHP use. In addition, the Academy Weapons staff was subsequently requested to perform an extensive test of all ten millimeter semi-automatic pistols, currently in production, having basic features considered acceptable for Departmental use.

The following report contains the results of this 10mm test along with the recommendation of the Academy Weapons staff indicating which weapon is considered most suitable for Departmental adoption. The recommendation is based on the performance of each 10mm weapon during testing, along with input taken from the 9mm semi-automatic field test conducted during 1989 which included specific functional characteristics considered to be necessary in a Departmental weapon. This recommendation also includes specific holster and ammunition pouch specifications along with a list of acceptable brands to assist in rapid procurement of these items.

II. Test Methodology

Purpose

The goal of the Weapons staff was to obtain all acceptable 10mm weapons currently available and to subject each one to identical test procedures then record their performance for final evaluation. The final evaluation involved the analysis of all data collected during the test and the subsequent identification of minimum acceptable specifications necessary for the adoption of a semi-automatic pistol for the California Highway Patrol.

The final specifications for a Departmental weapon were selected from design and functional characteristics already offered by individual weapon manufactures on submitted test samples and are not the result of any specific request by the test staff or any member of this Department.

Evaluation Criteria

Test weapons were evaluated in three primary categories, each containing pertinent subcategories. The primary categories were: "Design Characteristics" which included all important weights, dimensions, and basic functional characteristics of each weapon such as types of action,

decocking mechanisms, safeties, if present, and sights. The second category was "Firing Performance." This involved the actual firing of each weapon. Evaluations of weapon recoil, accuracy, malfunction frequency, breakage, durability, and safety were all included in this category. The third and final category was "Maintenance and Repair Features," which included all service and maintenance aspects unique to each weapon. This category addressed parts availability, armorers classes, if necessary, and any special tools or equipment required to service a particular weapon.

Specific test and compliance criteria is contained in Annex A of this report.

A checklist was prepared for each test weapon. These checklists contain a summary of the weapons performance and written evaluations of its various design and service characteristics. These checklists are included in Annex B of this report.

Test Staff

The members of the Academy Weapons staff participating in the testing of the 10 millimeter weapons were:

Sergeant E. Fincel	Weapons Staff Supervisor
Officer L. Osborn	Senior Weapons Instructor
Officer D. Kidwell	Weapons Instructor
Officer J. Randall	Weapons Instructor
Mr. R. Clark	Senior Gunsmith
Mr. K. Kagehiro	Gunsmith

Additionally, members of current cadet classes were utilized for recoil interpretation and weapon handling observations. These were recorded on the Test Weapon Performance Data Sheets and video taped for visual comparison.

Sample Identification

All weapons submitted for testing were done so in response to a letter of request from the California Highway Patrol. This letter was sent to all vendors normally receiving a bid solicitation package from the State of California Office of Procurement. A copy of this letter is contained in Annex F.

Three weapon manufacturers responded by submitting weapons for testing before the deadline stated in the request letter. These were Smith and Wesson Corporation, Glock Incorporated, and Colt Industries, Firearms Division. All other manufacturers either did not respond or sent correspondence indicating they would not be submitting test weapons.

The following is a list of all weapons submitted for testing:

Mfg. & Model	Caliber	Purchase Price
• Colt Industries		
1 each Model Double Eagle	10mm	$ 679.95
• Glock Incorporated		
1 each Model 20	10mm	358.80
1 each Model 22	10mm short (.40 S&W)	322.30
1 each Model 23	10mm short (.40 S&W)	322.30
• Smith & Wesson		
2 each Model 1006	10mm	$ 421.00
2 each Model 1076	10mm	425.00
4 each Model 4006	10mm short (.40 S&W)	437.00
(2 each frame mounted decocking lever)		413.00
(2 each standard safety model)		399.00

III. Recommendation

Based on all data collected and the evaluations of the test personnel, it is the recommendation of the Academy Weapon staff that the Department initiate a sole source purchase of a Smith & Wesson Model 4006 stainless steel semi-automatic pistol (standard safety model) in the caliber of .40 Smith & Wesson.

Exact purchase specifications have been prepared and are included with this report in Annex G. In addition, holster and magazine pouch acceptability lists have been prepared for the acquisition of all leather equipment compatible with the above-mentioned weapon. These lists are also contained in Annex G of this report.

As of this date, ammunition in the caliber of .40 Smith & Wesson is only manufactured by Winchester Corporation. Therefore, the Academy Weapons staff recommends the sole source purchase of the 180 grain jacketed hollow point cartridge, Stock # X40SW in sufficient quantities to accomplish all Departmental issue and training needs for the up-coming year or until such time as additional rounds of this caliber become available for testing by the Academy Weapons staff.

Test Summary

Compliance standards indicated in Annex A for all evaluation categories contained on the Test Weapon Performance Data Sheet (Annex B) have been established by the members of the Academy Weapons staff. These standards were based on input from the Department's 9mm semi-automatic field test and extensive research in the semi-automatic pistol and ballistics field. They are basic test criteria and each item has a specific justification relating to the field application for the California Highway Patrol officer.

Upon receipt from the factory, each weapon was completely inspected by the Academy gunsmith to ensure its compliance with the manufacturer's specifications. Any discrepancies found upon the initial inspection were noted on the weapon inspection checklist which was prepared for each weapon. Any weapon requiring correction of a problem found during this inspection was returned to the factory for the necessary repairs.

Once all weapons were approved for further testing, they were evaluated by the test staff using the evaluation criteria and performance data collection sheet located in Annex A.

Each weapon was weighed and measured to determine its external dimensions including its grip size and trigger reach. The weapon's basic design characteristics (items 1 through 8 on the Test Weapon Performance Data Sheet) were then addressed and evaluated. Each weapon's compliance and/or non-compliance in each category was recorded by checking the appropriate box on the checklist. Any comments regarding compliance and/or non-compliance were recorded in the comments section below the Design Characteristics category.

Once the weapons were evaluated on their basic design and functional characteristics, they were subjected to extensive performance testing. This included evaluations in accuracy, recoil, magazine changes, durability, and safety. Each test had specific criteria for acceptable performance with the exception of the recoil test, where interpretations of the test staff, along with comparison figures used by the Sporting Arms and Ammunition Manufacturers Institute (SAAMI) were used for evaluation (Annex E). Using two methods for recoil evaluation was more definitive of the actual effects of recoil because of the wide variation of shooter interpretation that could be made due to varying experience levels.

Endurance testing included the firing of 5,000 rounds of ammunition and recording the weapon's performance throughout the test. Malfunction rates were calculated for each weapon based on actual malfunctions experienced during the test firing. These rates were calculated based on the firing of all 5,000 rounds whether or not the weapon completed the test. A minimum malfunction rate was also established and included on the Test Weapon Performance Data Sheet. Criteria was also established for weapon failure due to parts breakage if any. Weapons were not considered to have failed if they simply required cleaning due to debirs and residue buildup. They were cleaned and lubricated and firing was continued. Once all other firing tests were completed, each weapon was subjected to a drop safety and drop function test to determine if it was capable of accidentally discharging if dropped or tossed a given distance. It was also tested to see if it would still function properly after being subjected to the drop testing.

The final category for evaluation was maintenance and repair aspects. The only two factors considered to be a necessity for all weapons were that each one be serviceable without the aid of tools for field stripping and cleaning by field officers and that armorers classes be available from the factory along with all tools necessary for gunsmith servicing and repair.

The specific performance of each weapon has been summarized on a Test Weapon Performance Data Sheet and placed in Annex B. The following is a brief summary of each weapons performance throughout the testing process.

Colt "Double Eagle" 10 Millimeter

The Colt Double Eagle complied with most of the criteria in the design characteristics category. It fell one round short in the minimum magazine capacity category and exhibited a minor bind in the upward travel of its decocking lever. The firing performance of the Colt weapon however, was plagued with numerous malfunctions. When all 267 recorded malfunctions were considered and calculated, it achieved a frequency rating of one malfunction every 18 rounds which was far below the minimum of one in 100 rounds. The Colt was found to be difficult to control when two- and three-shot groups were fired largely because of the strong recoil. Magazine changes with the Colt also posed a problem requiring the shooter to reseat the magazine with a slap over 30 times during the endurance testing. The Double Eagle suffered numerous instances of excessive wear and parts breakage. Finally, the firing pin disconnector lever broke and rendered the weapon incapable of being fired further. This occurred near the 4,800 rounds mark. (Refer to photos in Annex C.)

Glock Model 20, 10 Millimeter

The Glock #20 10mm was returned to the factory immediately after its arrival due to excessive clearance found between extractor and bolt face causing it to malfunction during the initial inspection test firing. It was returned with the problem corrected on March 15 and its testing was resumed. The Glock was the only weapon submitted for testing that had no hammer. All of the Glocks' firing mechanisms other than the trigger are contained inside the weapon's slide and grip frame. During the evaluation of the weapon design characteristics, it was noted that the magazine, whether loaded or empty, had to be physically extracted from the grip frame never dropping free as required in item 7a of the 10mm evaluation criterion (Annex A). The magazine follower also bound frequently inside the magazine body occasionally causing difficulty loading, in some instances even preventing the loading of the magazine to its capacity. Later in the testing, the follower also worked its way completely out through the top of the magazine past the feed lips.

The Glock #20 exhibited the strongest recoil of all 10mm pistols tested. This made it the most difficult of all weapons to control when firing multiple shot groups. When it was fired by trainees who were being observed by the test staff, the consensus of opinion was that the recoil was excessive and too heavy for officers of smaller stature and hand size.

During the endurance firing, some 205 malfunctions were experienced with the Glock #20. The magazines always had to be removed from the weapon by hand, failing to drop free on their own. The malfunction rate for the Glock #20 was calculated to be one in every 19 rounds. All failures are listed on the Test Weapon Performance Data Sheet included in Annex B. Firing was halted at approximately 3,800 rounds because of severe cracking and deterioration of the bolt face at the firing pin opening which caused repeated malfunctions. Additionally, upon final inspection of the weapon, cracks were found in the plastic frame rails adjacent to the magazine well at the rear of the barrel locking lug. (Refer to photos in Annex C.)

Glock Model 22, 10 Millimeter Short (.40 S&W)

Two Glock #22 weapons were involved in this testing. The first suffered a barrel rupture due to a defective bullet fired during endurance testing. Subsequently a second weapon was provided and subjected to the entire test battery.

As with the Glock #20, the magazine had to be manually removed from the grip frame of the weapon during each magazine change. The recoil generated by the Glock #22 when firing the test round was second only to the smaller framed Glock #23. This recoil was found to be difficult to control when multiple shot groups were fired. When small handed shooters fired the weapon, they all indicated that the recoil caused difficulty in control. The endurance test was completed with 37 recorded malfunctions which resulted in a malfunction rate of one in every 137 rounds fired.

The weapon was cleaned and allowed to cool on four occasions due to malfunctions occurring from debris buildup. Upon completion of the test, the weapon was inspected by the Academy gunsmiths. During this inspection, cracks were found in the plastic frame rails adjacent to the magazine well at the rear of the barrel locking block. (Refer to photos in Annex C.)

Glock Model 23, 10 Millimeter Short (.40 S&W)

The Glock #23 was the lightest and smallest of all pistols tested. It, like the other Glocks, would not allow the magazine to drop free when released. The magazine follower could also be twisted and bound inside the magazine. Recoil from the Glock #23 was substantially higher than

any other .40 caliber weapon fired. This resulted in much difficulty maintianing control when multiple shot groups were fired. The endurance testing of the Glock was halted at 1,038 rounds due to the breakage of the trigger spring rendering it incapable of continuing. To this point in the test, the Glock #23 recorded a malfunction rate of one in 25, experiencing 41 total malfunctions. Just as was found on the other Glock test weapons, the plastic frame was cracked adjacent to the magazine well behind the barrel locking block on the Glock #23. This was discovered during a final inspection of the weapon.

Smith & Wesson Model 1076, 10 Millimeter

During the initial evaluation of the Smith & Wesson #1076 10mm pistol in the design characteristics category, it was found to have rough or sharp edges in the trigger guard area which could cause discomfort to a shooter and did during later firing. It also was found to have a magazine floor plate which was not manufactured of a shock absorbing material.

The firing of the Model 1076 was considered by the test staff to be uncomfortable and occasionally painful due to contact with sharp edges of the trigger guard previously addressed. The firing of accurate multiple shot groups was difficult because of the strong recoil and discomfort caused by rough edges previously mentioned. The Model 1076 Smith & Wesson was considered to have failed the endurance portion of the firing test because of the breakage of a retaining clip for the hammer pivot pin and side plate which prevented it from continuing. The malfunction rate was calculated based on the firing of 1,000 rounds before this failure occurred. It was one in 500 rounds.

Smith & Wesson Model 1006 (Double Action Only) 10 Millimeter

The Model 1006 was found to have a defective ejector upon initial inspection which was replaced prior to any evaluation. The ejector prevented the magazine from dropping free when released. As with all other Smith & Wesson test weapons, the magazine floor plate was not manufactured of shock absorbing material.

The recoil for this weapon was again considered quite heavy. It was difficult to control when firing multiple shot groups as was the Model 1076. The design of the Model 1006 weapon contributed to this difficulty even more because of the longer double action trigger pull required for each shot. The Model #1006 fired 3,500 rounds with no malfunctions and then requiring cleaning due to debris buildup which caused six malfunctions. The pistol was subsequently cleaned and oiled then fired to over 5,000 rounds. The malfunction rate when computed was one in 844 rounds. The weapon suffered no parts breakage.

Smith & Wesson Model 4006 (Frame Mounted Decocker) 10 Millimeter Short .40 S&W

Two S&W Model 4006 pistols were tested; one with a decocking lever mounted on the left side of the frame, and the other with a manual safety/decocking lever mounted on both sides of the slide. The frame mounted decocking model was examined upon arrival and found to fail the design characteristic requirement stating that the magazine floor plate be manufactured of shock absorbent material. The recoil was found by all shooters to be the most manageable of all test weapons. This interpretation is supported by the recoil computations and comparison graphs found in Annex E. The minimal recoil indicated was a primary factor contributing to the favorable comments received in the controlability category. All shooters considered both of the Model 4006 pistols the most controlable.

During the endurance firing, the weapon was observed to have an extractor pin protruding out of its slot slightly and was subsequently pushed back into its slot. The retainer clip for the hammer pivot pin was noted to come loose and was pushed back into its slot by the shooter on three occasions. It subsequently had to be glued in place and therefore, was considered to have failed this portion of the testing.

The Model 4006 also was found to have broken an ejector near the 500-round mark, but never failed to fire or eject fired casings because of this problem. A total of seven malfunctions were logged producing a malfunction rate of one per 814 rounds.

Smith & Wesson Model 4006 (Slide Mounted Safety/Decocking Lever) 10mm Short .40 S&W

Upon initial inspection and design characteristic evaluation, it was noted that as with all Smith & Wesson weapons submitted, the magazine floor plate was not manufactured of or coated with a shock absorbing material. All test staff found the recoil to be tolerable and multiple shot groups were easily and accurately fired. The safety/decocking lever was easily accessible to all shooters.

This weapon exhibited the best performance during the endurance testing of all weapons tested. It fired 5,090 rounds with only two malfunctions and was never cleaned or lubricated after its initial inspection. The weapon achieved a malfunction rate of one in 2,545 rounds which was considered to be exceptional performance by the test staff.

The categories not specificly addressed in these summaries were not discussed because all weapons performed acceptably when evaluated or were addressed on the performance evaluation sheet (Annex B). Each pistols rating may be confirmed through examination of Annex B which contains the respective performance evaluation sheets.

Conclusion

When the Academy Weapons staff received instruction to extensively test and evaluate all models of 10 millimeter semi-automatic pistols currently available, written requests were promptly sent to handgun manufactures for the submission of weapons for testing. Copies of the request letters that were sent to all vendors normally receiving a bid solicitation package from the State Office of Procurement are included in Annex F. The only restriction imposed on the weapon manufacturers was that single action pistols that require manually cocking the hammer prior to firing would not be accepted for testing. Subsequent to the mailing of these request letters, three manufactures submitted test weapons chambered for the full size 10 millimeter cartridge. Additionally, two companies submitted samples of a weapon chambered for the shorter version of the 10 millimeter cartridge known as .40 S&W. All samples were received on or before the final date for acceptance stated in the original request letters.

The evaluation criteria established by the Academy Weapons staff was prepared with the specific needs of the California Highway Patrol officer in mind. It was developed from the combined input of the 9mm semi-automatic field study and pertinent test criteria extracted from the National Institute of Justice Testing standards, and the FBI 10 Millimeter Study. It was not intended to be used as a final specification by itself, but simply as a guideline for the determination of the best suited and most reliable weapon available at the time of the test.

Each model of the test weapons submitted was subjected to the same test criteria and its performance in each category documented. All weapons submitted for testing were of the highest quality, and failure of a weapon in any test category is not intended to infer otherwise.

All conclusions and recommendations have been based entirely on the performance of each weapon during its exposure to the test criteria. The Academy Weapons staff has considered all test data within this report and prepared final specifications for weapon procurement, which have been included in Annex G.

The identification of a weapon suitable for adoption was based solely on the level of performance it achieved and not on the lack of performance by any other test weapon. The following is a list of each test weapon along with its final rating including a brief listing of problems noted during testing.

MANUFACTURER	MODEL	RATING
Colt	Double Eagle	Unacceptable • Excessive malfunction frequency • Parts breakage • Controlability difficult • Magazine failures • Recoil excessive
Glock	#20	Unacceptable • Excessive malfunction frequency • Controlability difficult • Parts breakage • Frame cracks • Magazine failures • Recoil excessive
Glock	#22	Unacceptable • Magazine failures • Controlability difficult • Frame cracks • Recoil excessive
Glock	#23	Unacceptable • Magazine failures • Controlability difficult • Parts breakage • Frame cracks • Recoil excessive
Smith & Wesson	#1006D/A	Unacceptable • Controlability difficult • Recoil excessive
Smith & Wesson	#1076	Unacceptable • Parts breakage • Controlability difficult • Recoil excessive
Smith & Wesson	#4006 decocking lever	Unacceptable • Retainer clip failure
Smith & Wesson	#4006 standard safety	Acceptable

At the conclusion of the testing and evaluation, the weapon found to be most reliable, having the lowest malfunction rate, and easiest to fire accurately by all test staff was the Smith & Wesson Model 4006. The Colt sample suffered extensive parts breakage. All samples submitted by Glock suffered frame cracks after endurance firing. Two of the Smith & Wesson 10mm weapons submitted suffered parts breakage and difficulty with control. The final two test weapons were Model 4006 pistols from Smith & Wesson. They performed well with very low malfunction rates. The loss of a retainer clip was the cause for the unacceptable rating given to the frame mounted decocking version of the Model 4006 weapon.

The 10 millimeter cartridge is still quite new and the shorter .40 S&W version is even newer yet. Generally speaking, the performance of the weapons chambered for the full size 10mm load was poor at best. The Weapons staff feels this poor performance is primarily attributed to the sheer power generated by this new round and the future maintenance and up keep requirements of a weapon chambered for this round would be unacceptable. The shorter version of this round on the other hand proved to be much less punishing to the weapon and the shooter. Instances of excessive wear and parts breakage with the .40 S&W were found to be minimal.

The .40 S&W cartridge being shorter than the full size 10 millimeter is capable of being contained in a smaller grip frame, thus, enabling a smaller handed shooter to more comfortably handle the pistol. This difference in bullet case length has made it possible for the 10 millimeter bullet to be fired from a frame or pistol, the size of a nine millimeter. This obviously enables the weapon to be more universally adaptable for all sizes of shooters. More versatile weapon size, along with the performance spectrum of the .40 S&W cartridge, are two important factors which were considered by the test staff in the development of their final recommendations.

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Annex A - WEAPON EVALUATION CRITERION

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ANNEX A

10MM EVALUATION CRITERION

DESIGN CHARACTERISTICS

1. Weapon to be chambered for 10mm long or short (.40 cal. S&W) cartridge.

   - Compliance to be determined by visual inspection of weapon.

2. Weapon shall have a minimum capacity of 10 rounds of ammunition when fully loaded.

   - Compliance determined by actually loading weapon to determine magazine capacity.

3. a. All metal surfaces shall be treated in order to prevent corrosion, rust or discoloration of original finish, or have stainless steel non-reflective finish.

   - Compliance determined by visual inspection and confirmation with manufacturer. Where applied finishes are present specific descriptions are to be obtained from manufacturers including cost of reapplication.

   b. External finish shall be free from sharp edges or rough surfaces likely to cause injury or discomfort to shooter's hands.

   - Compliance determined by visual inspection of all external surfaces along with input from shooting test subjects.

4. Sights shall have white accent against black background to assist in rapid target acquisition and be adjustable for windage. Sights shall have non-reflective finish to reduce glare and/or light reflection.

   - Compliance determined by visual inspection of weapon's sight system.

5. Slide shall function smoothly without binding or dragging in both forward and rearward directions. Slide shall release smoothly and travel fully into battery from a locked-back position when chambering a dummy round from a loaded magazine. Slide must lock to rear when cycled fully back with empty magazine in place.

   - Compliance determined by actually releasing the slide from a locked-back position to chamber dummy round. Slide is then moved fully to rear with empty magazine in place to determine if it will lock to rear.

6. a. Trigger pull on double action and hammerless guns to be within 8 and 16 lbs. Single action trigger pull to be within 4 to 7 lbs. Trigger must operate smoothly with no detectable binding or dragging.

    - Compliance determined by measuring trigger pull with calibrated scale and recording each measurement.

7. Magazines

    a. All magazines, whether loaded or empty, must drop free from weapon when released.

        - Compliance determined by locking both loaded and an empty magazines in place and then releasing each. The magazine must fall free from weapon each time it is released. This test is performed with slide locked to rear and fully forward in battery.

    b. Magazine release must be located on the forward edge of the grip frame directly behind the trigger guard and be accessible to both right- and left-hand shooters.

    c. Magazine follower must move freely from top to bottom of magazine without binding and remain within the confines of the magazine housing.

    d. Magazine floor plate must be manufactured of shock absorbing material or similarly padded to avoid damage when magazine, whether loaded or unloaded, is dropped from weapon. The floor plate must protrude past forward edge of grip frame for easy removal should the magazine become stuck in weapon due to a malfunction.

    e. Magazines must be capable of being disassembled for cleaning without the use of tools.

        - Compliance determined by visual inspection along with disassembly and reassembly of magazines.

8. Safety Features

    a. Weapon must be constructed so that the firing pin is not capable of protruding through its opening in the bolt face unless trigger is fully depressed.

        - Compliance determined by visual examination of weapon while attempting to force firing pin through bolt face without trigger being depressed. Firing pin must not protrude through opening in bolt face.

b. Weapons that are capable of being cocked manually and said cocking reduces trigger pull to less than 8 pounds, must be equipped with a means of decocking that is totally separate from the trigger mechanism.

- Compliance determined by visual inspection and function testing decocking mechanism.

c. Manually operated safety mechanisms, if present, must be accessible from either side of the weapon.

- Compliance determined by visual inspection an manual fuction of mechanism by right- and left-handed test personnel.

FIRING PERFORMANCE

Accuracy

Weapon must be capable of firing a 5-shot group of 6 inches or less when hand held and fired from a bench-rest position, at a distance of 25 years. Group sizes are calculated by measuring the distance between the two rounds farthest apart in any single 5-shot group.

- Compliance determined by firing a 5-shot group from each test weapon. Weapon to be fired from bench-rested position by the same shooter for all test groups. Groups are then measured and targets retained.

Weapons without elevation adjustment must be capable of firing a 5-shot group with a center no more than 8 inches from point of aim.

- Compliance determined by measuring distance from point of aim to center of group and recording distance from point of aim.

Recoil

a. The recoil of a weapon being largely subjective must be interpreted by the shooter. However, the free recoil of a weapon determined by a mathematical computation can provide an evaluator with the means by which he or she may compare the recoil variance of each weapon for data collection and comparison purposes. Both subjective interpretations and free recoil computations were used in this test.

- Rather than establishing a minimum compliance standard, the free recoil figures were computed and, along with the interpretations of the test staff, have been included in the Annex section of this report on each Test Weapon's Performance Data Sheet for review and comparison.

Magazine Changes

The requirement that a magazine drop free when released was again evaluated during the actual firing of each weapon along with the requirement that the slide lock back when the magazine is empty. Any failures were recorded on the Test Weapon Performance Data Sheet.

Endurance Testing

Each weapon was subjected to the firing of 5,000 rounds and its performance closely monitored. All weapons were inspected prior to any firing and then fired for a maximum of 5,000 rounds. Weapons were only cleaned if they became sugglish in their operation and failed to go fully into battery occasionally due to residue build-up. This provided valuable input for future cleaning requirements of all test weapons. A malfunction rate of more than one malfunction in 100 rounds of fire was considered to be unacceptable performance for the purposes of this test.

Any weapon suffering a malfunction due to actual parts breakage of any type which rendered it incapable of continuing without the broken part or parts being replaced was considered to have failed this portion of the test. All malfunctions were recorded on that Test Weapon Performance Data Sheet. Malfunctions caused by faulty magazines, dirty actions, defective ammunition, etc., which could be cleared or corrected by the operator, were. The weapon was then checked thoroughly and testing was resumed. The extraction of fired cases by all weapons was also monitored during this portion of the test. Fired cases when being thrown from the weapon must not interfere with the shooter in any way. Any problems with extraction of fired cases were noted in the body of the endurance test evaluation section.

Drop-Safety Test

Each weapon was loaded with a primed ammunition case and then dropped from a height of one meter, on its muzzle, its back, and on each side to determine if the shell casing would discharge. It was then thrown 15 feet on a concrete surface and from a height of one meter for the same test motive.

Any weapon that discharged the primed casing was considered to have failed this test and subsequently disqualified from further testing due to the hazardous implications surrounding its failure.

Drop Function Test

Weapons successfully passing the drop-safety test were then subjected to the drop-function test. Each weapon was fully loaded with live ammunition and fired to determine whether or not it would still function correctly. A weapon was considered to have passed if it fired one full magazine without a failure or malfunction. Any weapon failing to fire one full magazine on the first attempt was given one additional attempt to complete the test.

MAINTENANCE AND REPAIR ASPECTS

1. Weapon must be capable of being disassembled for routine service without the use of any tools.

   - Compliance determined by disassembling weapon for service per manufacturer's instructions without the assistance of any tools.

2. Any specilized tools or printed material required for service or maintenance of weapon must be readily available through manufacturer.

   - Compliance determined through confirmation with manufacturers.

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Annex B - WEAPON PERFORMANCE DATA SHEET

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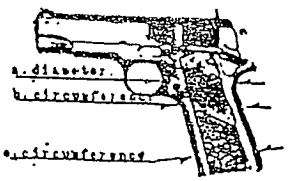
TEST WEAPON PERFORMANCE DATA SHEET

Control No. 9
Manufacturer COLT Model Double Eagle Series 90
Serial No. X27853

External Dimensions
Loaded Weight 44 oz.
Overall Height 5 7/8 in.
Barrel length 5 in.
Length 8½ in.

Grip Size
a. 3.01 in.
b. 5.92 in.
c. 6.44 in.



Design Characteristics

	Pass	Fail
1. Caliber: 10mm	x	
2. Capacity: (fully loaded) 9 rds.		x
3. External surfaces: Finish Stainless Steel	x	
Rough or sharp edges -	x	
4. Sights:	x	
5. Slide function:	x	
6. Trigger pull: SA 5½ lbs DA 13 lbs		
Hammerless Yes ____ No x		
7. Magazine: a. Drops free	x	
b. Release	x	
c. Follower	x	
d. Floor plate	x	
e. Disassembly	x	
8. Safety Features: a. Firing pin block	x	
b. Decocking lever	x	
c. Manual safety		NA x

Comments (items 1 thru 8) Item #2 Total weapon capacity nine rounds.
8b. Slight bind on upward travel of decocking lever.

Firing Performance

Accuracy: Group size 3 inches
Aim point deviation (fixed elevation only) 6 inches
Recoil:
Free recoil 5.9576 ft. lbs. energy Cartridge I.D.# 175 grain STHP 10mm

Test staff interpretation: Due to the design and contruction of the grip frame and front portion of the magazine floor plate, blistering of shooters hand normally occurred within the firing of 50 rounds.

Firing Performance (cont)

Magazine Changes

Difficulty Noted					5,000 Round Test Fire
None	Minimal 1-5	Occasional 5-15	Often 15-30	Excessive X Over 30 (fail)	Required i into magaz by slappir of floor p

Endurance Test

5,000 round continuous fire, weapons cleaned only if they malfunctioned.
Summary of Performance: Malfunction Rate: (1 rd. in 18 rds. fired).

After 4868 rounds were fired the firing pin disconnector lever broke rende the weapon incapable of being fired. The following parts breakages and ma were noted thoughout the testing process:

The firing pin disconnector broke at 4868 rounds. The ejector was foun be broken at the conclusion of the last firing. The trigger retainer was during firing. The firing pin stop finish was peeling. Magazines contino failed to seat properly into the magazine well. An exposed area around th trigger allowed space for debris to collect on the trigger mechanism. Wea required cleaning in order to continue functioning on four occasions durin testing.

198 Failures to feed.
23 Failures to go into battery.
23 Incidents of locking slide to rear with loaded magazine.
12 Failures of slide to lock open after the last round was fired.
1 Failure to extract empty casing.
1 Failure to eject empty casing.
1 Failure to fire.

	Pass	Fail
Drop safety test.	x	
Drop function test.	x	

Maintenance and Repair

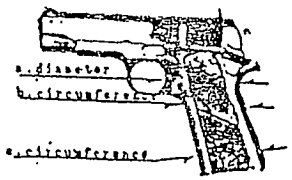
	Pass	Fail
1. Disassembly and reassembly.	x	
2. Specialized tools, etc. required.	x	

TEST WEAPON PERFORMANCE DATA SHEET

Control No. 10
Manufacturer Glock Model 20
Serial No. J 003 US

External Dimensions
Loaded Weight 39.5 oz.
Overall Height 5¼ in.
Barrel length 4 5/8 in.
Length 8¼ in.

Grip Size
a. 3.10
b. 5.92
c. 6.44



Design Characteristics

		Pass	Fail
1.	Caliber: 10 mm	x	
2.	Capacity: (fully loaded) 16 rds.	x	
3.	External surfaces: Finish Tenifer	x	
	Rough or sharp edges -	x	
	Refinish cost $20.00 per weapon.		
4.	Sights:	x	
5.	Slide function:	x	
6.	Trigger pull: SA NA lbs DA 6 lbs		
	Hammerless Yes x No		
7.	Magazine: a. Drops free		x
	b. Release	x	
	c. Follower		x
	d. Floor plate	x	
	e. Disassembly	x	
8.	Safety Features: a. Firing pin block	x	
	b. Decocking lever		NA x
	c. Manual safety	x	NA

Comments (items 1 thru 8) #6: Weapon provided with 5 lb trigger connector
#7a: Magazine will not fall free whether loaded or unloaded.
7c: Magazine follower wobbled and bound in magazine body.

Firing Performance

Accuracy: Group size 2 3/8 inch group.
Aim point deviation (fixed elevation only) NIL
Recoil:
Free recoil 6.6362 ft. lbs. energy Cartridge I.D.# Winchester 175 grain s

Test staff interpretation: The lightest of the 10mm weapons. The felt recoil was strong. When small handed cadets fired weapon it was obviously difficult to impossible to maintain grip. Heavy recoil was painful.

Firing Performance (cont)

Magazine Changes

		Difficulty Noted		5,000 Round Test Fire	
None	Minimal 1-5	Occasional 5-15	Often 15-30	Excessive Over 30 (fail)	Magazine r dropped fr be pulled each time

Endurance Test

5,000 round continuous fire, weapons cleaned only if they malfunctioned. C

Summary of Performance: Malfunction Rate: (1 in. 19 rds. fired)

Test firing stopped at 3866 rounds due to failures to fire caused by erosion and deterioration of firing pin opening in bolt face. This condit was such that rounds failing to feed completely were being struck by firin pin when weapon was not fully in battery. The weapon if discharged when out of battery could cause injury to shooter.
Below is a list of malfunctions by type and number experienced during firi test. Failure to feed round into chamber - 157. Failure of slide to go f forward into battery - 11. Failure to extract fired casing - 14. Failure fire when fully in battery - 10. Slide failing to lock to rear on last ro - 9. Slide locking back with rounds remaining in magazine - 8. Failure t empty case - 4. Fed 2 rounds at one time - 1.
Weapon was cleaned on 4 occasions during endurance firing and once prior t of endurance test. Weapon was lubricated after each cleaning. Magazine fo worked its way out of magazine body past feed lips causing it to require r be for magazine could be loaded. Cracks were noted in frame rails adjacen magzine well at rear of barrel locking lug during final inspection.
Extraction of spent rounds erratic often struck shooter in head.

	Pass	Fail
Drop safety test.	x	
Drop function test.	x	

Maintenance and Repair

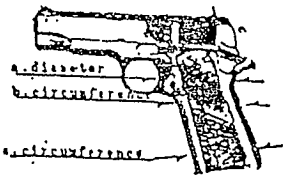
	Pass	Fail
1. Disassembly and reassembly.	x	
2. Specialized tools, etc. required.	x	

TEST WEAPON PERFORMANCE DATA SHEET

Control No. 11A
Manufacturer GLOCK Model 22
Serial No. J007US

External Dimensions
Loaded Weight 32.75 oz.
Overall Height 5½ in.
Barrel length 4½ in.
Length 8 in.

Grip Size
a. 2.80
b. 5.51
c. 6.11



Design Characteristics

		Pass	Fail
1.	Caliber: 10 mm Short (40 S&W)	x	
2.	Capacity: (fully loaded) 16 rds.	x	
3.	External surfaces: Finish Tenifer	x	
	Rough or sharp edges	x	
	Refinish cost $20.00 per weapon.		
4.	Sights:	x	
5.	Slide function:	x	
6.	Trigger pull: SA N/A lbs DA 9¾ lbs		
	Hammerless Yes x No		
7.	Magazine: a. Drops free		x
	b. Release	x	
	c. Follower	x	
	d. Floor plate	x	
	e. Disassembly	x	
8.	Safety Features: a. Firing pin block	x	
	b. Decocking lever		NA x
	c. Manual safety	x	NA

Comments (items 1 thru 8) #7 As stated by Carl Walter from Glock Inc., th slide could not be relied upon to lock back after the last round is fired. He indicated this was due a design problem with the prototype magazines pr for testing. Additionally, magazine insertion difficulty was experienced.

Firing Performance

Accuracy: Group size 4 5/8 inches.
Aim point deviation (fixed elevation only) NIL
Recoil:
Free recoil 4.8812 ft. lbs. energy Cartridge I.D.# 180 grain JHP. (40 (

Test staff interpretation: This weapon delivered a noticeably stronger recoil for some shooters when compared to other .40 Cal weapons tested. This was more evident as the amount of ammunition in the magazine decreased making the weapon lighter.

Firing Performance (cont)

Magazine Changes

		Difficulty Noted	5,000 Round Test Fire		
None	Minimal 1-5	Occasional 5-15	Often 15-30	Excessive x Over 30 (fail)	Magazine dropped weapon.

Endurance Test

5,000 round continuous fire, weapons cleaned only if they malfunctioned.
Summary of Performance: Malfunction Rate: (1 in. 136 rds fired.)

During endurance testing the weapon was cleaned and cooled down four tim
The following malfunctions were experienced during the 5000 round test.

20 Failures eject.
8 Failures feed.
3 Failures fire.
4 Failures go into battery.
2 Slide locked to rear with a loaded magazine.

An inspection of this weapon at the conclusion of this testing revealed a
crack in the plastic frame rail adjacent to the barrel locking lug insert

Extration of spent cases erratic; cases often struck shooter in face and
head. Very distracting.
Total rounds fired 5000.

	Pass	Fail
Drop safety test.	x	
Drop function test.	x	

Maintenance and Repair

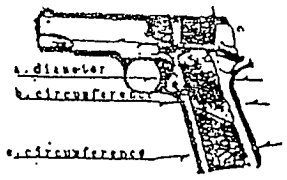
	Pass	Fail
1. Disassembly and reassembly.	x	
2. Specialized tools, etc. required.	x	

TEST WEAPON PERFORMANCE DATA SHEET

Control No. 12
Manufacturer Glock Model #23
Serial No. J010US

External Dimensions
Loaded Weight 29 oz.
Overall Height 5 in.
Barrel length 4 in.
Length 7¼ in.

Grip Size
a. 2.80 in.
b. 5.43 in.
c. 5.81 in.



Design Characteristics

		Pass	Fail	
1.	Caliber: 10 mm short (40 Cal S&W)	x		
2.	Capacity: (fully loaded) 14 rds.	x		
3.	External surfaces: Finish Tenifer	x		
	Rough or sharp edges -	x		
	Refinish cost $20.00 per weapon.			
4.	Sights:	x		
5.	Slide function:	x		
6.	Trigger pull: SA N/A lbs DA 6½ lbs			
	Hammerless Yes x No			
7.	Magazine: a. Drops free		x	
	b. Release	x		
	c. Follower		x	
	d. Floor plate	x		
	e. Disassembly	x		
8.	Safety Features: a. Firing pin block	x		
	b. Decocking lever			NA x
	c. Manual safety	x		NA

Comments (items 1 thru 8) #7a - Magazine fails to drop freely. It's necessary to manually remove the magazine from the grip frame. #7c - Maga follower became twisted causing ammunition to be chambered improperly.

Firing Performance

Accuracy: Group size 3 5/8 in.
Aim point deviation (fixed elevation only) 2½ in.
Recoil:
Free recoil 5.5124 ft. lbs. energy Cartridge I.D.# Winchester 180 grain JHP 40 CAL

Test staff interpretation: This weapon delivered substantially more felt re when compared with the Glock Model 22 and other 40 caliber weapons tested. recoil was especially noticeable during the firing of the last two or three rounds in a magazine.

Firing Performance (cont)

Magazine Changes

		Difficulty Noted		5,000 Round Test Fire	
None	Minimal 1-5	Occasional 5-15	Often 15-30	Excessive X Over 30 (fail)	Magazine r dropped fr weapon.

Endurance Test

5,000 round continuous fire, weapons cleaned only if they malfunctioned.
Summary of Performance: Malufunction Rate: (1 in. 25 rds. fired)

At 1038 rounds the trigger spring broke. This malfunction due to an actua parts breakage which rendered it incapable of continuing without the broke part being replaced was considered to have failed this portion of the test

Prior to the parts breakage, this weapon experienced the following malfunc

18 Failures to feed.
8 Failures to fire.
9 Failures to eject.
6 Failures to fire due to the weapon not going completely into battery Extractor hook digging into the case body. (in extractor groove.)

An inspection of this weapon at the conclusion of this testing revealed a crack in the plastic frame rail adjacent to the barrel locking lug insert. Extraction of fired cases erratic. Cases would strike shooter often.

	Pass	Fail
Drop safety test.	x	
Drop function test.	x	

Maintenance and Repair

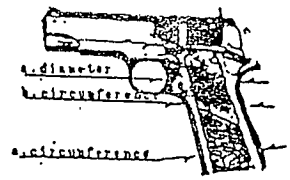
	Pass	Fail
1. Disassembly and reassembly.	x	
2. Specialized tools, etc. required.	x	

TEST WEAPON PERFORMANCE DATA SHEET

Control No. #2
Manufacturer Smith & Wesson Model 1076
Serial No. TET 5739

External Dimensions
Loaded Weight 45 oz.
Overall Height 5 15/16
Barrel length 4½ in.
Length 7 7/8 in.

Grip Size
a. 3.10
b. 5.47
c. 5.72



Design Characteristics

		Pass	Fail
1.	Caliber: 10mm	x	
2.	Capacity: (fully loaded) 10 rounds	x	
3.	External surfaces: Finish Stainless Steel	x	
	Rough or sharp edges Trigger Guard Area		x
4.	Sights:	x	
5.	Slide function:	x	
6.	Trigger pull: SA 6.5 lbs DA 12.5 lbs		
	Hammerless Yes ____ No x		
7.	Magazine: a. Drops free	x	
	b. Release	x	
	c. Follower	x	
	d. Floor plate		x
	e. Disassembly	x	
8.	Safety Features: a. Firing pin block	x	
	b. Decocking lever	x	
	c. Manual safety		NA x

Comments (items 1 thru 8) #7d. Magazine floor plate not made of shock absorbant material. #3 Sharp edges noted around trigger guard.

Firing Performance

Accuracy: Group size 3½"
Aim point deviation (fixed elevation only) 1 inch
Recoil:
Free recoil 5.8252 ft. lbs. energy Cartridge I.D.# Winchester 10mm STHP

Test staff interpretation: Recoil was considered strong by all shooters and excessive by some due to larger grip frame and difficulty in maintaining firm grip.

Firing Performance (cont)

Magazine Changes

			Difficulty Noted		5,000 Round Test Fire
None	Minimal 1-5	x	Occasional 5-15	Often 15-30	Excessive Over 30 (fail) _____

Endurance Test

5,000 round continuous fire, weapons cleaned only if they malfunctioned.
Summary of Performance: Malfunction rate 1 in 500 rounds.

At 500 rounds extractor pin was protruding out of its housing and subsequently reseated. At 1000 rounds side plate "E" clip was found to have broken and fallen off. Weapon failed to continue to fire and was subsequently considered to have failed this portion of the test.

	Pass	Fail
Drop safety test.	x	____
Drop function test.	x	____

Maintenance and Repair

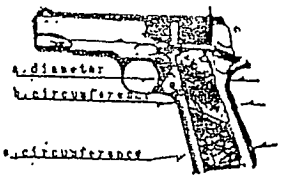
	Pass	Fail
1. Disassembly and reassembly.	x	____
2. Specialized tools, etc. required.	x	____

TEST WEAPON PERFORMANCE DATA SHEET

Control No. #3
Manufacturer Smith & Wesson Model 1006
Serial No. TEP 2762

External Dimensions
Loaded Weight 46 oz.
Overall Height 5 15/16 in.
Barrel length 4½ in.
Length 4½ in.

Grip Size
a. 3.12
b. 5.47
c. 5.71



Design Characteristics

		Pass	Fail
1.	Caliber:	x	
2.	Capacity: (fully loaded) 10 rds.	x	
3.	External surfaces: Finish Stainless Steel	x	
	Rough or sharp edges -	x	
4.	Sights:	x	
5.	Slide function:	x	
6.	Trigger pull: SA NA lbs DA 12.5 lbs		
	Hammerless Yes ___ No x		
7.	Magazine: a. Drops free		x
	b. Release	x	
	c. Follower	x	
	d. Floor plate		x
	e. Disassembly	x	
8.	Safety Features: a. Firing pin block	x	
	b. Decocking lever		NA x
	c. Manual safety		NA x

Comments (items 1 thru 8) 7a: On initial inspection magazine did not drop free when released from weapon due to defective ejector which was subsequer replaced and problem corrected. 7d: Magazine floor plate not made of shoc absorbent material.

Firing Performance

Accuracy: Group size 3 1/8 inches.
Aim point deviation (fixed elevation only) 3 inches.

Recoil:
Free recoil 5.6986 ft. lbs. energy Cartridge I.D.# Winchester 10 mm STH

Test staff interpretation: Recoil considered heavy by most shooters mainta consistant grip was very difficult.

Firing Performance (cont)

Magazine Changes

Difficulty Noted 5,000 Round Test Fire

None	Minimal 1-5	x	Occasional 5-15	Often 15-30	Excessive Over 30 (fail)	

Endurance Test

5,000 round continuous fire, weapons cleaned only if they malfunctioned.
Summary of Performance: Malfunction Rate: (1 in. 844 rds fired)

Weapon fired over 3500 rounds with out a malfunction. Between 3500 and 5068 rounds weapon failed to go into battery on 6 occasions it was oiled and continued to fire with no further problems. Total rounds fired were 6189.

	Pass	Fail
Drop safety test.	x	
Drop function test.	x	

Maintenance and Repair

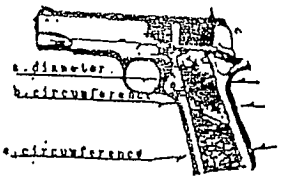
	Pass	Fail
1. Disassembly and reassembly.	x	
2. Specialized tools, etc. required.	x	

TEST WEAPON PERFORMANCE DATA SHEET

Control No. #5
Manufacturer Smith & Wesson Model 4006 (Side decocke
Serial No. X508

External Dimensions
Loaded Weight 45.5 oz.
Overall Height 5 5/8 in.
Barrel length 4 1/16 in.
Length 7¼ in.

Grip Size
a. 2.90
b. 5.67
c. 5.90



Design Characteristics

		Pass	Fail
1.	Caliber: 10 mm Short (40 S&W)	x	
2.	Capacity: (fully loaded) 12 rds.	x	
3.	External surfaces: Finish Stainless Steel	x	
	Rough or sharp edges -	x	
4.	Sights:	x	
5.	Slide function:	x	
6.	Trigger pull: SA 6 lbs DA 12½ lbs		
	Hammerless Yes ____ No x		
7.	Magazine: a. Drops free	x	
	b. Release	x	
	c. Follower	x	
	d. Floor plate		x
	e. Disassembly	x	
8.	Safety Features: a. Firing pin block	x	
	b. Decocking lever	x	
	c. Manual safety		NA x

Comments (items 1 thru 8) 7d: Magazine floor plate not manufactured of shock absorbant material.

Firing Performance

Accuracy: Group size 3 3/8 inch
Aim point deviation (fixed elevation only) N/A

Recoil:
Free recoil 3.5078 ft. lbs. energy Cartridge I.D.# Winchester .40 S & W 180 Gr. JHP.

Test staff interpretation: Recoil considered to be acceptable by all test staff including Academy cadets.

Firing Performance (cont)

Magazine Changes

		Difficulty Noted	5,000 Round Test Fire	
None X	Minimal 1-5	Occasional 5-15	Often 15-30	Excessive Over 30 (fail)

Endurance Test

5,000 round continuous fire, weapons cleaned only if they malfunctioned.
Summary of Performance: Malfunction Rate: 1 in. 814 rounds.

Extractor pin started to move slightly and was reseated at 500 rounds. At 500 rounds weapon found to have broken ejector. However, never failed to fire and eject spent cases through entire test. "E" clip that retains delocking side plate came loose on 3 occasions weapon still functioned cl was reseated and glued on last occasion. Never loosened again.
Round 4840 failed to go fully forward into battery
Round 5340 failed to eject last round fired.

Total rounds fired - 5700.

	Pass	Fail
Drop safety test.	x	
Drop function test.	x	

Maintenance and Repair

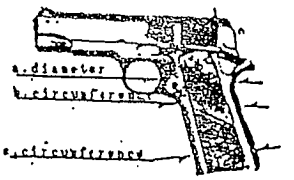
	Pass	Fail
1. Disassembly and reassembly.	x	
2. Specialized tools, etc. required.	x	

TEST WEAPON PERFORMANCE DATA SHEET

Control No. 8
Manufacturer Smith & Wesson Model 4006
Serial No. X520

External Dimensions
Loaded Weight 45.5 oz.
Overall Height 5 5/8 in.
Barrel length 4 1/16 in.
Length 7⅛ in.

Grip Size
a. 2.90
b. 5.67
c. 5.90



Design Characteristics

		Pass	Fail
1.	Caliber: 10 mm Short (40 Cal S & W)	x	
2.	Capacity: (fully loaded) 12 rds.	x	
3.	External surfaces: Finish Stainless Steel	x	
	Rough or sharp edges	x	
4.	Sights:	x	
5.	Slide function:	x	
6.	Trigger pull: SA 6½ lbs DA 13 3/4 lbs		
	Hammerless Yes ____ No x		
7.	Magazine: a. Drops free	x	
	b. Release	x	
	c. Follower	x	
	d. Floor plate		x
	e. Disassembly	x	
8.	Safety Features: a. Firing pin block	x	
	b. Decocking lever	x	
	c. Manual safety	x	NA ____ NA ____

Comments (items 1 thru 8) 7(d) Floor plate not manufacture of a shock absorbing material.

Firing Performance

Accuracy: Group size 2 1/8"
Aim point deviation (fixed elevation only) 1"
Recoil:
Free recoil 3.5078 ft. lbs. energy Cartridge I.D.# Winchester 180 grain JHP 40 cal.

Test staff interpretation: Felt recoil considered to be acceptable to all test staff and cadet trainees. Grip size was compatable to all shooters as well as comfortable. Slide action found to be smooth. Decocking lever/ safety was accessible to both right and left handed shooters

Firing Performance (cont)

Magazine Changes

Difficulty Noted 5,000 Round Test Fire

None	Minimal	X	Occasional	Often	Excessive
	1-5		5-15	15-30	Over 30 (fail)

Endurance Test

5,000 round continuous fire, weapons cleaned only if they malfunctioned.
Summary of Performance: Malfunction Rate: (1 in. 2545 rounds fired.)

The weapon experienced two failures during the 5000 round endurance testing. On the 700th and 2440th rounds the slide failed to lock into the rear position on an empty magazine.

With the exception of the failures mentioned above, this weapon required no cleaning in order to continue firing.

Total rounds fired 5090.

	Pass	Fail
Drop safety test.	x	
Drop function test.	x	

Maintenance and Repair

	Pass	Fail
1. Disassembly and reassembly.	x	
2. Specialized tools, etc. required.	x	

Test and Evaluation

10 mm Semi-Automatic Pistol

Annex E - FREE RECOIL COMPUTATIONS AND COMPARISONS

May 1990

GUN RECOIL EQUATION
SAAMI - Technical Correspondent's Handbook
(Source - Winchester)

The Free Recoil Energy (FRE) of a firearm can be described as:

$$FRE = \left[\frac{W_f}{64.34}\right]\left[\frac{(W_e)(V_e) + (\text{Chg. Wt.})(V_{pg})}{(7000)(W_f)}\right]^2$$

Where:

$V_{pg} = (V_e)(f)$

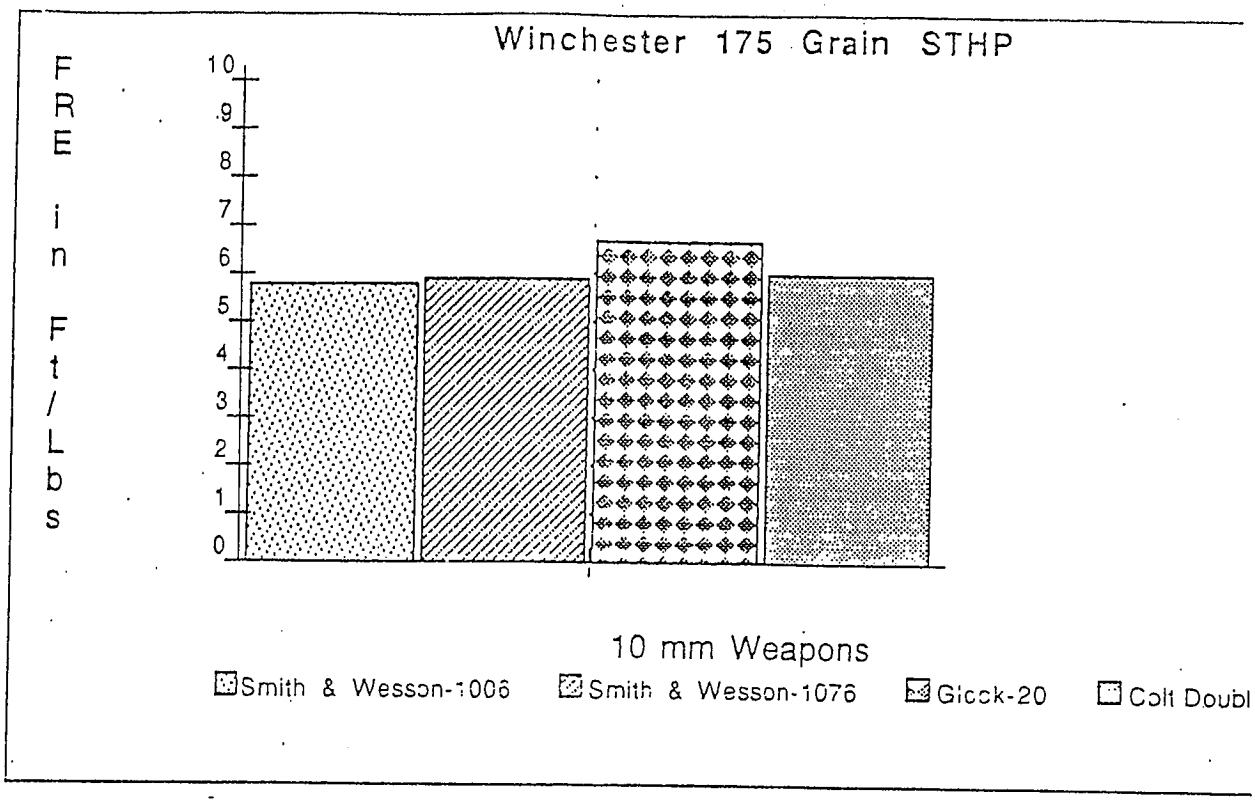
f = 1.50 for pistols and revolvers
f = 1.75 for high powered rifles
f = 1.25 for long barrelled shotguns
f = 1.50 for average length shotguns

Then:

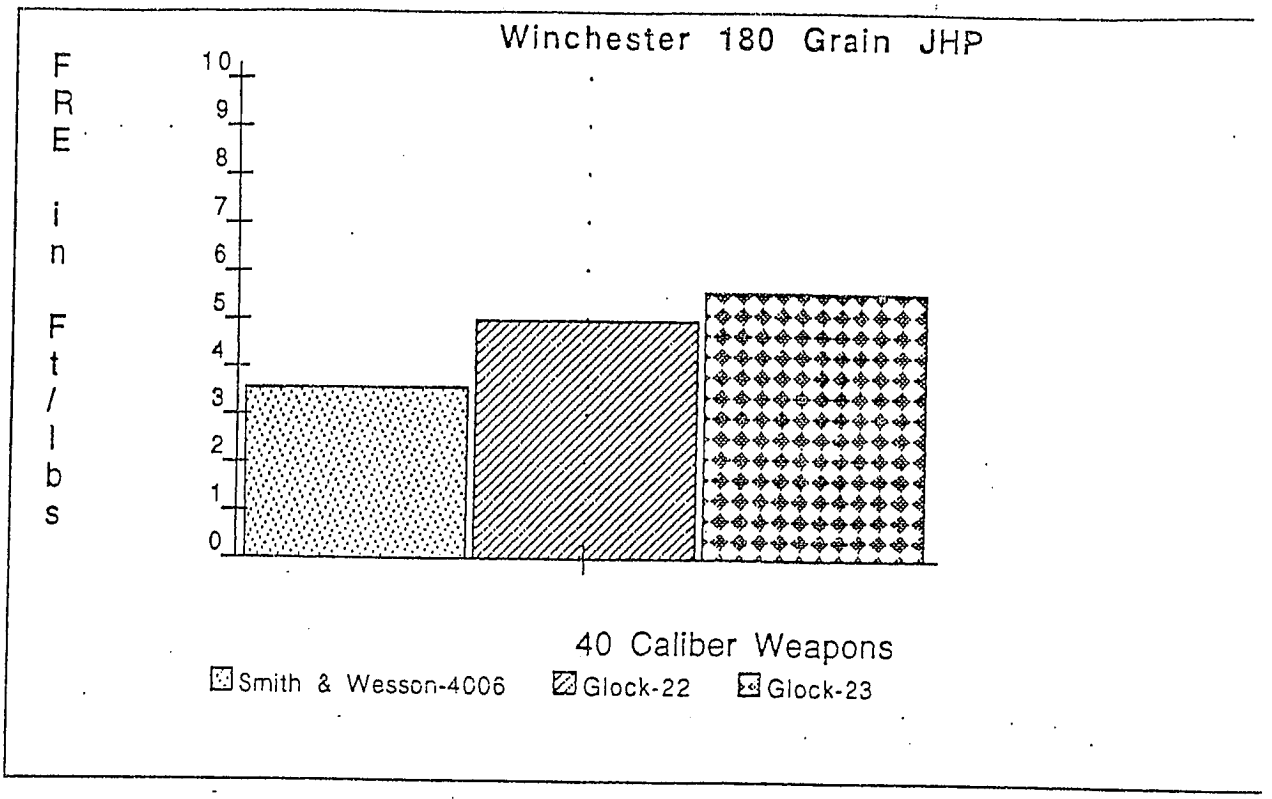
$$FRE = \left[\frac{W_f}{64.34}\right]\left[\frac{(W_e)(V_e) + (1.5)(V_e)(\text{Chg. Wt.})}{(7000)(W_f)}\right]^2$$

W_e = Weight in grains of the ejecta (bullet + wad column)
V_e = Velocity of ejecta in fps
Chg. Wt. = W_{pg} = Weight of propellant gases (use powder charge weight in grains)
V_{pg} = Velocity in fps of propellant gases
W_f = Weight of firearm in pounds + loaded magazine/cylinder

Conversion Factors	
27.3438 grains = 1 dram	(437.5 grains = 1 ounce)
16 drams = 1 ounce	
16 ounces = 1 pound	



WEAPON	Weight of Gun (Lbs)	Winchester Weight of Ejecta (grains)	175 Grain Charge weight (grains)	STHP Velocity of Ejecta (fps)	Gun coefficient	Free Recoil Energ (Ft-lbs)
Smith & Wesson-1006	2.875	175	12.5	1173	1.5	5.6986
Smith & Wesson-1076	2.8125	175	12.5	1173	1.5	5.8252
Glock-20	2.4688	175	12.5	1173	1.5	6.6362
Colt Double Eagle	2.75	175	12.5	1173	1.5	5.9576



WEAPON	Weight of Gun (Lbs)	Winchester Weight of Ejecta (grains)	180 Grain Charge weight (grains)	SHP Velocity of Ejecta (fps)	Gun coefficient	Free Recoil Energy (Ft-lbs)
Smith & Wesson-4006	2.8483	180	7.5	928	1.5	3.5078
Glock-22	2.0469	180	7.5	928	1.5	4.8812
Glock-23	1.8125	180	7.5	928	1.5	5.5124

Test and Evaluation

10 mm Semi-Automatic Pistol

Annex G

May 1990

1. Semi-Automatic Pistol Specifications

PISTOL SPECIFICATION

1.	ACTION	Auto Loading, Double Action, Recoil Operated
2.	CALIBER	10mm Short (.40 S&W Cal.)
3.	BARREL LENGTH	3 1/2" to 4 3/4"
4.	WEIGHT, EMPTY	39 Oz. Max.
5.	MATERIAL	Stainless Steel
6.	FINISH	Satin (Non-reflective) with no roughness or sharp edges.
7.	SIGHTS	Non-reflective Black - 3 Dot System. Front - Post, with white dot (replaceable). Rear - Low mount combat, Adj. for windage with 2 white dots (NOVAK). Sight Radius - 5" minimum Sight Adjustment - At time of deliver, shall be set to provide a point of impact for 25 yards with the Winchester 180 gr. .40 S&W round and provide the following adjustment: The group center of ten (10) rounds fired from a fixed rest on a target at twenty-five (25) yards distance shall coincide with the point of aim and shall have thirty (30) percent minimum, of the sight adjustment range remaining for each direction of windage adjustment.
8.	SAFETY DECOCKING LEVER	Ambidextrous operating levers. Combined to provide a firing pin block and return the action to the uncocked position.
9.	CAPACITY	12 rounds (with standard magazine)
10.	GRIPS	Shall be one piece, wrap around textured, shock resistant material, available in at least 2 size/shapes to accommodate hand sizes.

11.	TRIGGER	Shall have a smooth contact surface, operate smoothly, provide a crisp release and a trigger pull as follows: Double Action: 8-14 lbs. Single Action: 4-7 lbs.
12.	TRIGGER GUARD	Shall be entirely smooth with no grooves or serrations on any exposed surface.
13.	HAMMER	To be flush with slide when decocked. (No spur or rowell.)

MAGAZINES

1. All magazines, whether loaded or unloaded, must drop free from weapon when released.

2. Magazine release must be located on the forward edge of the grip frame directly behind the trigger guard and adaptable and accessible for both right- and left-hand shooters.

3. Magazine follower must move freely from top to bottom of magazine without binding.

4. Magazine floor plate must be manufactured of shock absorbing material or similarly padded to avoid damage when magazine, whether loaded or unloaded, is dropped from weapon. The floor plate must protrude past forward edge of grip frame for easy removal should the magazine become stuck in weapon due to a malfunction or contamination.

5. Each weapon to be provided with seven (7) magazines (four magazines to be fitted with black floor plate and three to be fitted with bright red floor plate). Additional floor plates of each color must be available for separate acquisition if required.

FUNCTIONAL REQUIREMENTS

1. Weapons submitted for consideration shall have received an acceptable rating from the CHP Academy weapons testing staff during the 10 millimeter test and evaluation prior to May 1990.

2. Pistol shall be designed and constructed so that it may fire a chambered round by a single trigger pull with its hammer in any position (fully forward, fully cocked to rear or half-cock position).

3. Hammer must remain in the full cocked back position after each initial firing of the pistol for subsequent firing to be performed in a single action mode.

4. Subsequent to the feeding and firing of the last round from any factory provided magazine, the slide shall lock back in its rear most position and remain locked back until released by shooter depressing external slide release lever.

5. Weapon must be constructed so that the firing pin is not capable of protruding through its opening in the bolt face unless trigger is fully depressed.

6. Slide Disconnector: Weapon shall be constructed so that it cannot fire (hammer will not fall) unless the slide and barrel are fully locked into battery.

7. Weapon will be provided with a lifetime warranty against defective materials and workmanship covering all parts and the magazine. It shall be equivalent to or better than that which is offered to the retail customer.

8. Vendor/Manufacturer agrees to maintain a ready supply of replacement parts and special service tools, to ensure providing special request parts within 5 working days of request and within 30 days of standard parts requests.

9. All instruction necessary for the service, maintenance, and proper operation of the pistol shall be provided to the Academy Weapons personnel by factory instructors at their facility, as part of the initial purchase of the pistol. All travel, lodging and associated costs shall be provided by the manufacturer as part of the original purchase agreement, and documented on Std. 262, State Travel Expense Claim.

10. All weapons received are subject to Quality Control inspection per inspection test procedures 1005-01D-02.

2. Leather and Related Accessory List

HOLSTER AND MAGAZINE POUCH SPECIFICATIONS
SEMI-AUTOMATIC PISTOL

HOLSTERS (GENERAL SPECIFICATIONS)

1. All holsters to be made from 8 to 9 oz. top grain leather or equivalent leather appearing synthetic material and be specifically designed by th manufacturer for the weapon carried within it.

2. All visible leather or synthetic material shall be black and be finishe with hand-stamped basket-weave design using "Craftool Co. #511 Basket-Weave and Craftool #433 Sunburst Border Stamp."

3. All stitching shall be lock-stitched, 6 stitches per inch, using hot waxed #5 cord linen thread or better.

4. All visible metal snaps and/or snivels are to be solid brass screws, pir or rivets shall have permanent black finish.

5. The safety strap, when snapped over holstered weapon, must not permit an rearward movement of weapon or accidental "cocking" of the hammer.

6. The trigger guard of the weapon must be covered to prevent access to the trigger when the weapon is holstered and snapped in place.

7. The holster must secure the weapon against accidentally falling or bouncing out when wearer is running or jumping, whether or not safety strap is snapped in place.

8. The holster shall not be lined with any material or fitted with any objects, that will contribute to excessive wear or damage to the weapon's finish or the clothing of its wearer.

9. The holster shall be so designed as to enable its wearer to release the weapons safety strap or straps in a single motion. The weapon must then be capable of being removed from the holster with one additional continuous motion.

10. The holster shall have a securely fashioned belt loop with a minimum of 4-1/2 inch separation between the holster and loop. The measurement will be made from the top inside loop opening to the point where the loop is attached to the holster. This will allow a jacket to fit properly within the separation (Jacket Model Holster).

11. The belt loop shall be so constructed as to have sufficient tension to insure rigidity when drawing the weapon from the holster. It shall be affixed to the holster in such a manner as to prevent twisting and weakening under intensive use.

HOLSTER - ACCEPTABLE STYLES

1. Holsters shall be a top draw or semi-break front design, standard high ride or border patrol style (tip of barrel canted to rear of officer). The muzzle area shall be open to prevent the collecting of dirt and dus

ACCEPTABLE BRANDS LIST

Only hoslters that have been evaluated and approved by the Academy Weapon staff for safety, security, and functional reliability, and subsequently approved by the Department's Uniform Committee are authorized for wearing by members of this Department.

The following is a list of acceptable brands and models authorized for on du use:

AMMUNITION POUCH

1. Ammunition pouch shall be constructed of 6 to 7 oz. top grain leater or equivalent leather appearing synthetic material, and be constructed to accommodate two magazines side by side.

2. Pouch must be designed and constructed specifically for the magazines being carried within it.

3. All visible leather shall be black and be finished with #511 Craftool Basket-Weave and #43 Craftool Sunburst Border Stamp.

4. All visible metal snaps or rivets shall be solid brass.

5. All stitching shall be lock-stitched with six threads per inch using hot waxed #5 cord linen thread or better.

6. Pouch shall have a belt loop or slots on its back enabling its wearer to carry magazines either vertically or horizontally along a 2 1/4 inch wid Sam Browne belt.

7. Pouch shall have an individual flap over each of the two magazines. Eac one shall be secured by either a snap or Velcro fastener and operate independently of the other.

ACCEPTABLE BRANDS LIST

The following is a list of acceptable brands along with specific model numbers for ammunication pouches authorized for wearing by member of this Department.

3. Ammunition Specification

AMMUNITION SPECIFICATION

The .40 caliber S&W cartridge is currently manufactured by Winchester Corporation exclusively. The 180 grain jacketed hollow point Stock # X40 SW was found to be the best performing bullet when tested by the weapons testing staff. The Academy Weapons staff, therefore, recommends the sole source purchase of the following bullet in sufficient quantities to accomplish the training and issue requirements for the Departmental semi-automatic adoption and transition.

	Ammunition
Caliber:	.40 Cal. S&W
Manufacturer:	Winchester Corp.
Bullet Weight:	180 grain
Bullet Design:	Copper jacketed controlled expansion
Powder:	Olin ball powder WPR280 or equivalent (treated to reduce muzzle flash)
Case:	Brass, polished (brass in color).
Minimum Velocity:	Bullet to achieve an average velocity of no less than 900 feet per second.
Bullet Expansion:	Bullet must expand to an absolute minimum of .65 caliber when fired into ordinance gelatin mixed at 10 percent from a distance of 15 feet when fired from Smith & Wesson Model #4006.
Penetration:	Shall be a minimum of 14 inches into a block of ordinance gelatin mixed at 10%. Bullet fired a distance of 15 feet.